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Title:
FluidCam 1 & 2 - UAV-based Fluid Lensing Instruments for High-Resolution 3D Subaqueous Imaging and Automated Remote Biosphere Assessment of Reef Ecosystems

Key Words: reefs, costs, biosphere

Abstract:
We present NASA ESTO FluidCam 1 & 2, Visible and NIR Fluid-Lensing-enabled imaging payloads for Unmanned Aerial Vehicles (UAVs). Developed as part of a focused 2014 earth science technology grant, FluidCam 1&2 are Fluid-Lensing-based computational optical imagers designed for automated 3D mapping and remote sensing of underwater coastal targets from airborne platforms. Fluid Lensing has been used to map underwater reefs in 3D in American Samoa and Hamelin Pool, Australia from UAV platforms at sub-cm scale, which has proven a valuable tool in modern marine research for marine biosphere assessment and conservation. We share FluidCam 1&2 instrument validation and testing results as well as preliminary processed data from field campaigns. Petabyte-scale aerial survey efforts using Fluid Lensing to image at-risk reefs demonstrate broad applicability to large-scale automated species identification, morphology studies and reef ecosystem characterization for shallow marine environments and terrestrial biospheres, of crucial importance to improving bathymetry data for physical oceanographic models and understanding climate change's impact on coastal zones, global oxygen production, carbon sequestration.